

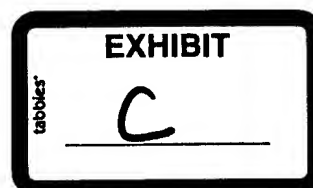


MICROSOFT WHITE PAPER

Places Plus: How connected, contextual computing can transform people's experience of public places

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[REDACTED]

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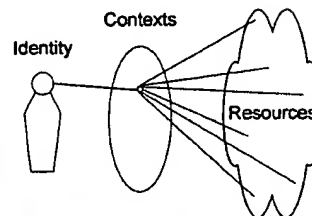


Introduction

Connected, contextual computing can transform our experience of public places. Microsoft has the assets to make this happen, and make money doing it.

Public places represent the Third Frontier for personal computing; business and the home were the first two. Most retail dollars will be spent in physical public places for many years to come, even though in-home on-line purchases will continue to grow rapidly. Great public places will always be a prime location for socializing and for merchandisers to close sales. Communities will look to them as a measure of their quality of life.

Delivering place-based services entails knitting together context, identity (of users, devices, services, etc.) and resources (data and people). Context provides the lens that focuses all the people and data I need down the what's relevant to me – my current persona, right here, right now.



[REDACTED]

The Way Forward

[REDACTED]

The core of this system would be a context engine and associated interfaces. It is somewhat analogous to a search engine, in that it is an infrastructure service that gains value from a large data store and depends on clever algorithms. It probably provides more "user stickiness" than a search engine, though, since its value is tied directly to a user's identity.

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There are six appendices which drill down on some of the issues covered in the text.

Framework

Trends Driving Place-specific computing

To start with the obvious: access to information is becoming ubiquitous. Soon most people will have smart devices, and there will be e-kiosks everywhere. Network connectivity will be taken for granted, and wireless access to data "in the cloud" and nearby devices will be common. Computing will become distributed and embedded in the environment, and digital overlays on the physical world will be common.

The roll-out of Wireless E911 services will provide some of the infrastructure required for place-specific computing, such as geo-location of devices at scales less than 100m. Customers will be open to such services since they offer increased personal safety, a primary need, and since they will have become hooked on information feeds on their desktops.

The social context of place is also evolving. Shops will increasingly become places to socialize as many routine purchases are done on line. As theme parks have become shops, so shops will become theme parks.

Last but not least, increasing suburban density and a growing awareness of the problems associated with sprawl will lead to a demand for Third Places. People will seek ways to break out of the boring monocultures of single-use zoning that shape their bi-polar home/work lives. The Baby Boom will also make its mark, as usual: empty-nesters will seek out safe ways to make friends and socialize in their new neighborhoods.

General Assumptions

Matter matters

Human contact and the physical environment will always be of the highest value. The Microsoft campus should be sufficient proof: face-to-face meetings are crucial and frequent, and people don't like to be in buildings too far away from the action. The importance of travel, both for business and personal reasons, also attests to the importance of personal contact.

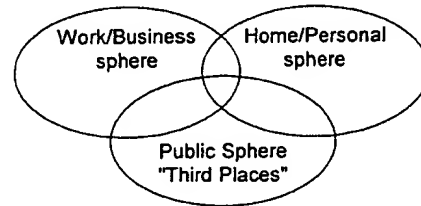
As for stores: People like to touch stuff. An Infobeads study found that 53% of PC purchasers prefer hands-on shopping. The New York Times reported that REI has found that customers who are "multi-channel" shoppers (using both stores and the Web) spend on average \$150 more per visit than single-channel shoppers.

People will continue to want the "high touch" aspects of retailing, and will continue to make impulse purchases. People like to hang out in places with other people, and take pleasure from sitting in the sunshine, having someone serve them, get a coffee shop "experience" they can't make at home. Malls will offer *ramblas*, nice gardens and

terraces, and essentially charge people for spending time. For similar reasons, bookshops and coffee shops go together: if you spend the time, you'll spend the money.

We need more Third Places

Healthy people and societies need healthy "Third Places." The term was coined by Ray Oldenburg to describe cafes, coffee shops, bookstores, bars, hair salons, and other hangouts that are the heart of a community. (The first and second places are home and work.) The advantage of Third Places is that they have neither the emotional baggage of home life nor the hierarchy and politics of work. They provide places where one can be known yet remain somewhat anonymous.



Automobile mobility, single use zoning and dual-income family life have undermined the viability of many Third Places. However, the need for them has not gone away; indeed, increasing pressures at home and work make them more essential than ever. I'm betting that connected computing can contribute to the resurgence of Third Places. The result will be a significant increase in the quality of urban and suburban life.

All new technologies reconfigure places

All new technologies reconfigure places, not least because they change people's ways of doing things. They also change power structures and business models, which in their turn impact public places.

The automobile is the paradigmatic example. Among other things, it led to the development of suburbia and edge cities; drove the evolution of retailing from downtown stores to regional malls; created new political constituencies, e.g. Soccer Moms in SUVs; and not least, created strip malls and homogeneous traffic congestion.

Similar effects can be adduced for other technology introductions: Railroads created the "T" configuration (railroad and Main Street at right angles) of towns across the continent; electric light transformed the urban night landscape and changed store layouts and display by replacing dim, acid-forming and sooty gas lights; and downtown mass transit seems to encourage pedestrian shopping areas.

Humans use tools to tune their environments, according to Marshall McLuhan. Connected contextual computing is simply another tool, and one that will also re-form the physical environment. I'd like Microsoft to be leading, not following, this change.

The impacts of connected contextual computing on the built environment will include new roles and configurations for brick & mortar stores and downtowns; new ways and places that facilitate face-to-face socializing; more venturesome citizens who feel safer and more informed about new places, and feel more ownership of the whole of their cities; and perhaps ways to ameliorate the unintended negative side effects of cars, e.g. sprawl.

Device Assumptions

Citizens will own many devices, some of them mobile. They will gain access to information in public places both via the personal devices which they own, and personalizable public devices they might encounter. The bottom line: "The platform isn't the device, it's all the devices together."

Smart phones will be pervasive, but won't be the only intelligent appliances that people will carry or encounter. There will be PDA's, smart wallets, public terminal and in-vehicle appliances.

Fixed devices will be important data access points. Some will be headless, e.g. wireless connectivity hotspots at gas stations. Others will be next-generation ATMs and phone boxes. Some will be new, e.g. enhanced e-ticket kiosks. They will support a wide variety of display sizes, from in-table screens to kiosks to billboards. Interactive devices will include micro-kiosks (imagine a processor in every lamp-post) and interactive billboards that use place and visitor data to optimize public advertising to their audience in real time.

Most physical objects will have data overlays, i.e. geo-tagged counterparts in the digital world.

Devices will need to express multiple user personas. Citizens will use both devices/services they've bought themselves and those provided by their employers. Personal data will migrate onto all machines, whether they are nominally used for work or personal purposes.

Defining Public Places

A place is a configuration of matter and information that structures people's activities. "Information" encompasses factual data, subjective meanings, and social rules. "Activities" includes both thinking and doing. More detail on place definitions can be found in Appendix Three.

The *Places Plus* project focuses on primarily on physical, public places, although the digital aspect of physical places is critical to their redefinition. I have imposed this constraint since there are significant efforts already under way in the company to create on-line communities, and since the impacts of computing on personal and corporate spaces are reasonably well understood.

Context and Identity

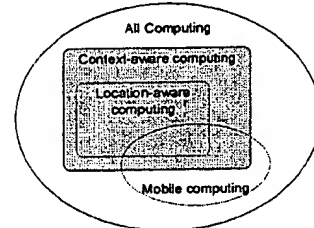
In a world where computing is pervasive, time-pressure relentless and mobility a given, contextualizing information is vital. Citizens need constant access to their personal resources (where "resources" means people as well as the data), but they don't need all of it all the time.

The notions of context, identity and resources provide a useful structure for thinking about place-based services. Of course, the same framework applies more generally to all kinds of computing.

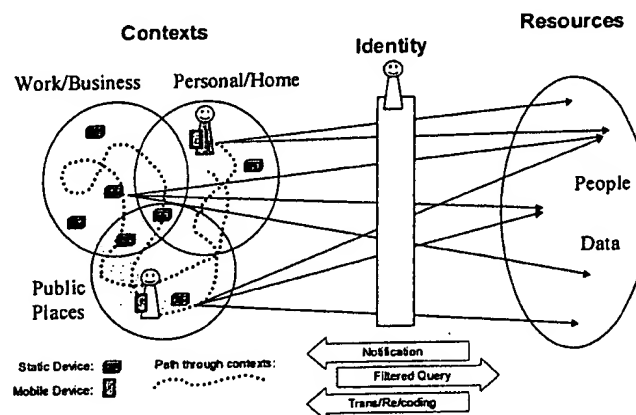
Context

Context can be defined as any information that characterizes the situation of an entity, where an entity can be a person, place or object. Key elements of context include a personal identity (who), and the social (who, what), physical (where, when, why) and digital environments (where, what, how).

Context awareness is the use of context to provide task relevant information. It can be used to present information, execute services and tag information. Since personalizing content is a primary application of context, a viable context aware architecture requires portable personal profiles.



In the course of a day users move through a multi-dimensional space of contexts, which can be broadly classified into home, work and public places. They encounter devices in the environment, and carry their own with them. The resources they need differ from context to context.

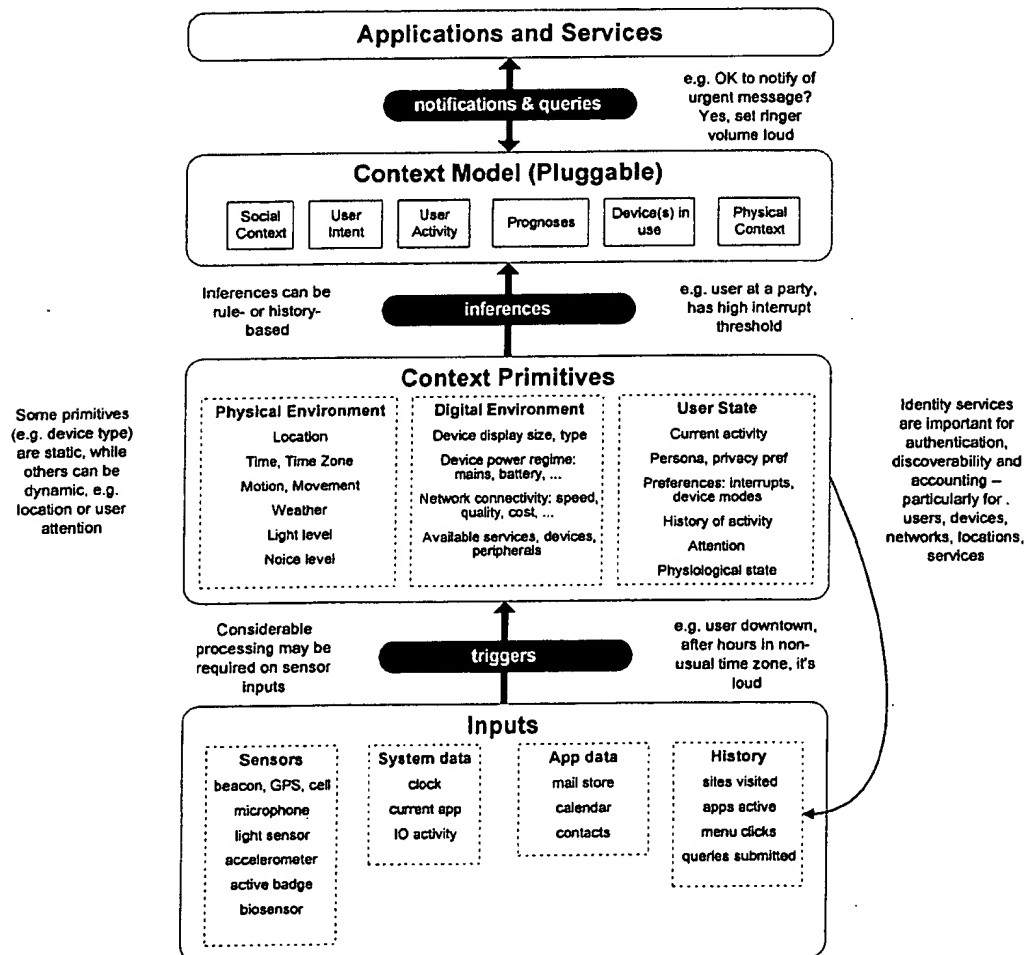


Location is only one aspect of context, though one that is quite relevant for mobile services. However, other elements of context such as personal preferences and

schedule are equally (if not more) important. For example, the combination of time and a calendar entry may be a more straightforward way to determine that I'm in a particular meeting than an inaccurate GPS or cell-site datum. Non-locational context is also very relevant to desktop computing, e.g. polling for and responding to user attention in a helpful way.

A context engine can be used to tailor information and content to a user's individual profile and location. Candidate content includes alerts, messages, itinerary information and financial services. Such an engine needs to integrate data of various types and origins, present interfaces to applications that wish to use it, and provide services that abstract and/or merge high-traffic data subsets into application-useful context primitives. Data flow will be two way: notifications will be pushed to the user, they will be able to make queries filtered by context, and information will be returned to them in the format appropriate to their device context.

The functions of a context system can be graphically represented as follows:



Middleware requirements for a context-aware system are outlined in Appendix Four.

Devices that are context-aware can understand/observe/accept the social conventions of places. This enables them to:

- Maintain anonymity – identities are protected and conversations aren't recorded in some circumstances
- Maintain confidentiality – information provided isn't forwarded to certain people/devices in a room
- Observe in/out of place rules – alerts sound when one ventures or comes close to areas that are not open to the public; devices only vibrate and don't ring in meetings; wireless transmitters turned off while planes are airborne
- Enforce hierarchy – some individuals/devices are allowed to offer data, and change rules, while others are not
- Observe "speaking rules" – how to gain attention, e.g. get access to control the slides

Context also helps a device be helpful and pro-active, e.g. reminding me to buy a table when I pass a hardware store, or helping me navigate around traffic jams.

Identity

Identity is a largely static descriptor of entities in the system; it mediates access to resources. [REDACTED] proximity namespace provides an excellent framework for user and other identities. It includes ways to name people, devices, services, venues/spaces, networks and processes.

The complexity of a context system derives in part from the fact that identities are in a many-to-many relationship. For example, one user will use many devices; some devices, e.g. in the home or in public places, may have many users; and each user or device will need to access multiple services, perhaps using multiple networks simultaneously or concurrently.

User identity is special since by representing the end-user and his/her preferences it becomes a key determinant of which services are delivered. People will maintain multiple electronic personas (work, family, personal); work personas will change through job hopping or overlapping contractual relationships. Any identity architecture will have to support multiple, constantly configurable personas and the ability to know who I am at any time, and turning personas on and off.

Profile information is a key component of user identity, and includes:

Profile Component	Examples	Typical file size
Work/lifestyle modes	Privacy/availability to various people at various times, default calendar for different categories	< 1kB
Financial	account numbers & passwords, credit cards, financial portfolio, insurance	< 1kB
Access	PKI keys, machine logons, MSN Passport, keys to house and car, biometrics	< 1kB
MS Office settings	Toolbars, doc templates, dictionaries	1kB

Desktop settings	Most Recently Used lists for desktop and apps; lists of printers and network resources that I usually access	1kB
Personal	Emergency medical info	15kB
History	Trace of use activity such as apps used, mouse movement, purchases	30kB
Search scopes	Inventory of stuff I've seen before, my current work files, etc.	variable
Web settings	Favorites cookies user identities	< 300kB 60kB < 1kB
Natural IO	Speech rec profiles handwriting rec profiles	< 500kB < 100kB
PIM data	Contacts Calendar	900kB 900kB

[REDACTED]

Smart cards are a great way to carry information, or pointers to information, securely. Some information will be carried on a card, and bulkier files kept on server. Smart cards will carry personal IDs and perhaps cookies and document templates; this information need not be stored centrally. Handwriting recognition profiles are too large for the current generation of smart cards, and will likely be stored on a server. Access to web favorites, speech profiles and calendar will have to be done via a more capable device, e.g. accessing a server via a public terminal, carrying the data in more expensive storage (e.g. CF card), or using an intelligent appliance. Biometrics can be used as the basis for a very secure cardholder authentication scheme (card holder to card). See Appendix 5 for a tabulation of card/biometric/server trade-offs.

[REDACTED]

One could debate the extent to which context, identity and resources overlap. The identity I assume at a given time and place is part of the context of my activity. Similarly, the local resources that are available are also part of context. However, I believe that identity and resource are sufficiently significant to call them out separately from other elements of context.

User Scenarios

Sixth Sense

Most of the services that will be described below use digital information overlaid on physical objects and places. It all comes together in my dream product: the Sixth Sense Service.

The interface is a barely visible earplug that feeds me information about my world. It brings me messages/conversation with friends everywhere, and another layer of input about the place I'm in. The earplug will also be a microphone; I will be able to control the information flow, and ask questions: When was this house built? Why is there an empty lot here? What good movies are showing locally? Where can I get my muffler fixed?

It's a way to learn about a neighborhood: as I walk along, I hear the voices of the people who live and work there. I can tune in to a shopkeeper talking about how he came to the place, how he got started in business, and his favorite customers; a homeless person's story; a town hall debate on whether to widen sidewalks or build a new park; children talking about their favorite playground games. A street could suggest good places to park, provide a congestion forecast, and warn me when the time on my parking meter is about to expire. "Annotated gardens" will be able to tell me about any plant - what it is, why it was planted there, how to grow my own.

My Sixth Sense Service will help me know what's around the next corner, perhaps by tuning in to a web cam on the next lamp post. I will tell me how many people have been walking around this area recently; whether any of my friends are around, and which upcoming events might be of interest. It'll make me feel safer, more informed and more connected to the social fabric.

This service will be build on an infrastructure of visible and invisible markers in the physical world. It will, of course, also have access to non-place-specific information. Most objects will eventually have digital-world representations: they will live a double life. Kids will go on treasure hunts to find physical things with clues from the "dirt world", or vice versa. Artists will create works where meaning is a mixture of physical and cyber elements (see Appendix 6, *Distributed Narratives*).

Requirements on Public Places

Abraham Maslow's hierarchy of needs is a useful guide to what people seek in public places. Starting with the most basic, he categorized needs as follows: physiological; safety; love, affection and belonging; esteem, of self and others; and self-actualization.

Many "lifestyle" and "productivity" products, including ours, are tailored to meeting esteem and self-actualization needs. We're just beginning to address the more basic "love and belonging" needs with person-to-person communication tools like chat. We have largely ignored "safety" needs, perhaps the most pressing ones in public places. Satisfying physiological needs, especially for food, drink and protection from the elements, is the

rational for many Third Place businesses, but they don't lend themselves to the kind of services I'm considering.

Using Maslow as a priority framework, then, people in public places want to be:

- Safe, not threatened, and in control of their situation
- Connected to other people and to important information sources
- Efficient at their tasks
- Happy and contented
- Stimulated by their environment

This leads to a desire for places that are secure, useful, entertaining, clean, exciting, predictable, accessible and comfortable.

The things particular people want from an environment will vary depend on their situation. For example, students looking for a good time will seek out places that are entertaining and exciting. Seniors who are out on the town are also looking for someplace entertaining, but security and comfort will be more important to them than excitement. A parent shopping with a toddler will most value somewhere that's secure, useful, clean and accessible.

Connected Contextual Computing can satisfy some of these needs more easily than others. For example, it can help make places feel "secure" (emergency alerts), "useful" (helping to find stuff), "predictable" (information feeds on what's available) and "entertaining" (social connections, media overlays). It is less well suited to making environments feel clean, accessible and comfortable.

A taxonomy for place-based service scenarios

[REDACTED]

- Safety – automatic crash notification, emergency notification, personal security
- Community – location-based instant messaging & notification, bulletin boards, lonely hearts
- Tracking – stolen vehicle tracking, elderly/handicapped monitoring, child monitoring, monitoring valuable personal possessions, commercial property
- Travel – real-time traffic alerts, routing assistance, itinerary support
- Convenience – mobile yellow pages, e-commerce, information services, phone service/infrastructure, kiosks, hotspots
- Fun & Entertainment – planning/finding activities, data-enhanced experiences, place-based games

(Note that there isn't a non-trivial mapping from these categories to the frequently-used "web lifestyle" categories: Communications, Entertainment, Convenience, Personal Productivity, and Information.)

Safety

The scenario that tests best in focus groups is one in which a citizen in a dangerous situation (e.g. a medical emergency or car crash) can summon emergency assistance to their location. Proposed devices include automatic sensors connected to in-vehicle phones, and custom key fobs. They require minimal software on the client, most of the infrastructure is staffing a response center. The response center matches the caller's identity to a profile, and forward their location to an emergency agency. Such services are available now.

Such a service is probably a requirement for most place-based services, but doesn't really use the power of our software.

A more sophisticated service could provide citizens with information to help them feel safer wherever they go, for example by alerting them when they're entering a neighborhood where crime statistics exceed their preset comfort level. One can also imagine a high-bandwidth service that allows people to "see around corners" by accessing video feeds from lamppost cameras.

Community

Location-enhanced messaging services can help people socialize. For example, a citizen taking a lunch break in a city park can check if any of her friends are close by; she can call them to arrange a rendezvous. Likewise, a group of friends can arrange to have the location advertised to their shared buddy list when they turn up at their local haunts; someone at home or elsewhere can be alerted when two or more buddies show up at the same place.

More generally, anyone entering a public place (e.g. airport, convention, bus stop, or bar) could use such a system to look for friends or find people that fit a certain profile, people that share their bus stop and are interested in a rideshare.

Connected contextual computing can also create Third Places that are part physical and part digital. One could use low-power FM transmission in a specific PCS cell to create a "radio bubble." A talk jockey would moderate voice chat among the people that show up at that same place every day at the same time. For example, commuters stuck on the west high-rise of the 520 bridge every morning between 8 and 8.30 am might enjoy talking among themselves. Many of them people on the bridge are already talking on the phone, and they undoubtedly share interests and demographics.

One can also imagine a "highway bubble" in which a mobile group with shared interests, e.g. snowbirds heading south in the Fall in their RVs, can exchange experiences and make plans. Such a service is a way of creating a sense of "moving place".

Related scenarios include: match making at clubs and parties (cf. Lovegety), place-specific bulletin boards, personalized notifications of events in a particular place, and rich name tags that encode affiliation and trust.

[REDACTED]

Tracking

Ways to keep track of children and elders are moderately interesting to most people. With such a service one might be alerted when an individual left a particular area, or one could obtain a map with their location on demand.

(Privacy issues invariably surface when discussing such services. However, concerns generally lessen as citizens become educated about the benefits of such services.)

Services that track belongings such as cars or valuables are less appealing to most consumers, though they are valuable to companies that need to track assets and shipments. Such services are available today.

Tracking services resemble safety services in that they don't require a great deal of software sophistication, at least on the client side. The location infrastructure needs to be ubiquitous and reliable, however.

Travel

Scenarios that serve travelers with place-based information are the most viable "convenience services" in the near term. Since many planners and IT executives travel a great deal, these scenarios are well rehearsed. For example:

A traveler builds an itinerary which is sync'd with his PIM and converted into a series of appointments (flight times), contacts (hotel addresses) and to-do's ("confirm return flight"). When the traveler checks in at an e-ticket kiosk, a tracking/alert relationship is set up; flight changes and gate information will be relayed to him. Itinerary changes and ticket purchases can be done directly on his mobile device.

On arrival at the destination airport, his device pings a hotel or rental shuttle, and provides feedback on how long the wait will be. On boarding a rental shuttle, his device transmits club membership details to the on-board system for forwarding to the pick-up point.

When he climbs into his rental car, his personal appliance syncs its itinerary, phone list and speech rec profile with the in-vehicle device. The in-car device infers his driving preferences and itinerary and provides navigation. The driver can use speech commands for navigation, phone dialing and dictation. The in-car device uses real-time traffic alerts to provide routing assistance. It can also provide geo-concierge services such as directions the nearest ATM, gas station or restaurant.

The user profile carried by the traveler enables rapid hotel check-in, configuration of room networking, call forwarding and wake-up call defaults. It can also provide the user's desktop on a rented machine if he chose not to bring his own.

Many of the navigation and concierge services mentioned are available now or being tested, though in a piecemeal form. The itinerary conversion, profile transfer and proximity networking features are not. The confidentiality of information shared between private and public devices is an open issue.

Venue Convenience

While shopping in a mall I get alerted if a product I've been searching for on-line is available here, and the service helps me navigate to the boutique. I have the option to purchase the item digitally, for example while sitting in Starbucks, but picking it up when I'm ready to leave – no more waiting for FedEx. The service helps me find my way around the mall, e.g. to find a product, bathroom or exit. It can also help me find family members, friends or a sales assistant.

Once I'm in a store I can find out more about any of the items on sale by consulting its digital overlay. The store can make me personal offers based on previous purchases or, if I authorize access to a subset of my personal information, remind me that an anniversary is coming up and make suggestions. When I'm ready to leave a sales assistant can ring up the sale on his portable device; I don't have to go to a podium for cash/wrap.

Related scenarios: location-based cell phone billing, game stats and community at public events; billboard displays that customize their advertising to the people who are passing by; an Electronic Crier that provides place- and people-specific news and a gossip feed, e.g. listings of upcoming events filtered by my preferences and location.

Device Convenience

An awareness of context can make devices more useful. In the following scenario it is assumed that devices can detect their physical context (motion, noise) as well as the usual location and logical status.

For example, imagine I'm sent an urgent message while on the road about a business account while entertaining those very customers at a nightclub. Given the relevance of the message, derived from my calendar, the system decides to ignore my default after-hours "no business messages" preferences. It relays the message to my phone in my handbag: it is registering noise and movement while all my other devices are quiescent. It ensures the rings loudly to ensure that I notice it.

Related scenarios: enlarge font size of message on PDA if I'm using it while walking; switch on device back-light in a darkened room; switch off ringer in meeting; ping me when I'm near a store I need to visit.

Simple awareness of location and calendar can also provide useful context, of course. For example, my PDA can remind me of a meeting sufficiently far in advance to allow me to travel to the venue from wherever I happen to be.

Some of the motion/noise context features have been prototyped by researchers. I'm not aware of any integrated systems.

Entertainment

While driving to the game, I get advance notice of parking situation. Different parking operators compete for my business; my agent trades off price vs. proximity. While at the game, I can choose to see player stats, scores around the league, audience participation games broadcast by team owners or find my buddies who are at this game. Perhaps I can connect to a Cayman Island gambling server to bet on outcome of the next play. I can order food from nearest vendor who's also inside the stadium. The venue reminds me of upcoming games, and offers discounts; my software my agent finds open schedule slots that match the offer. As game nears its close I consult Sidewalk to pick a restaurant and make a reservation. Other people had the same idea, and the restaurant offers to page me when table is 30 minutes from ready to confirm that I'm still coming. If necessary, it can give me directions.

Related scenarios: treasure hunt game, virtual maze in a real city.

[REDACTED]

Place-based Context Services

Service arbitration

Citizens will need digital gatekeepers in a world where everybody will be offering their service everywhere. A context- and preference-aware "service arbitration service" will reduce the cacophony by deciding which offers to pass through. For example: which of the merchant barking at me should I listen to; which of the people looking for companionship might appeal to me; do I want additional stats on the batter at the plate [REDACTED], or a ball-by-ball commentary for visiting fans [REDACTED]? [REDACTED]

Topology

The spatial and social barriers between different locations are not encoded in a simple grid locator. A service could offer to resolve, say, whether a product vendor in a sports venue is on the right side of the stadium boundary, or which of two places is in fact closest in terms of elapsed time walking from one's current position.

This service will have high value since collecting the baseline information for resolving queries will be laborious. Compare, for example, NavTech's pre-eminent position in GPS navigation services to their on-going investment in sending people out to find one-way streets, update roadwork status, etc.

Name resolution

Since the semantic content of places changes at various degrees of resolution (e.g. when I'm in a room the details of the house's neighborhood is unlikely to be relevant) the names used may vary at different granularities. One of the features of a naming service would be to translate between equivalent descriptions that apply at different resolutions or in different contexts.

For example, a maintenance crew might describe a broken door lock as #135 while the store owner knows it as *lock.side-entrance.door.MyStore*. One might use different mixes name types in different settings, e.g. describing the same printer variously as *my.empty-queue*, *nearest.double-sided*, and *HP-laserjet.Room3314*.

Trust

Customers will want some reassurance that a place, service or individual is who they purport to be. For example, I might want to ensure that the provenance of the antique I'm considering is accurate. Validation may be quite granular: I may require a colleague's mark of trust before sharing a document with John Doe, even though John can prove that he's an employee of a large company we have an NDA with.

Market makers are often already in place for well-established venues, e.g. a stock exchange or shopping center. However, ad hoc trust services could be useful for exhibitions, yard sales and gun shows.

Etiquette

People are reasonably smart about observing the social rules of a place, e.g. whether asides are allowed in a given meeting, who defers to whom, or whether using a tape recorder is appropriate. As companion devices become pervasive, they will also need to observe place-based rules such as:

- a PDA switching off its audio alerts while in a meeting;
- not allowing a cellphone connected to a laptop with Bluetooth to attempt a call if the device is in an airborne plane;
- automatically exchanging vCard info in a business meeting, but not on a trade show floor.

The enforcement of "place rules" for devices will probably follow human precedents, e.g. being voluntary in some cases and mandatory in others. Devices will probably have greater need for rule authorities and arbiters of etiquette than humans, however. An etiquette service could (a) advertise/impose rules in specific places, and/or (b) offer to interpret application of those rules for particular devices.

Location-based messaging/notification

This service enables you to be notified when, say, your friends are in your vicinity or at a location where you often meet. It allows citizens to get together for an ad hoc cup of coffee, or find out when a bunch of the guys are out at the soccer field. [REDACTED]

Smart Venues

Such a service would allow venue owners, e.g. a shopping mall, to provide additional services to their customers. It enables them to help customers know about special offers, find a particular product/store, learn more about a product without the help of a sales assistant if they choose, and complete a transaction without finding a sales terminal.

Smart messaging

Ubiquitous computing and information overload makes it important to get the right message at the right time, on the right device. A context-enhanced messaging service can ensure delivery to the most relevant device (e.g. the one jiggling in your handbag that you used five minutes ago, not the one sitting quietly in your briefcase) and make sure that the alert is loud enough to be heard over the noise in a bar.

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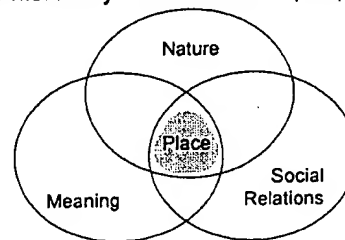
Appendix 3: Defining "Place"

A place is a configuration of matter and information that structures people's activities.
"Information" encompasses factual data, subjective meanings, and social rules.
"Activities" includes both thinking and doing.

A public place is a venue where anyone can expect to gain access. It includes public (streets, parks, libraries) as well as semi-public spaces (malls, airports, stadiums). The latter can be understood following the Americans with Disability Act (ADA) as "places of public accommodation", which are a private businesses that offers goods, services, or activities to the general public.

Places can be physical and/or digital (not "real" vs. "virtual" – all useful places are real).
Emerging technologies provide ways to overlay digital and physical places using tagging.

Places can be nested or overlapped – there is no simple hierarchy – and different people can experience different places in the same physical space. Physicality is not the only, or even the dominant, aspect of place. Robert David Sack defines places as the confluence of three "forces": nature, meaning and social relations. A place is a human construct, and thus has a particular set of meanings, e.g. its significance in one's life, or its symbolism for an ethnic group. Since many people can use a place, social relations determine, for example, what activities are allowed and prohibited in a given space.

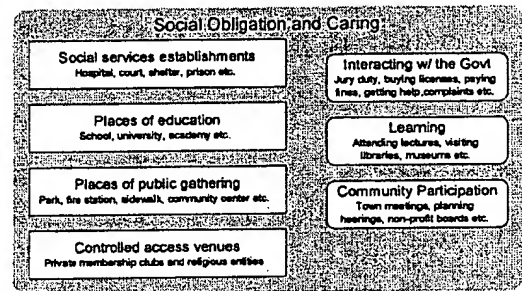
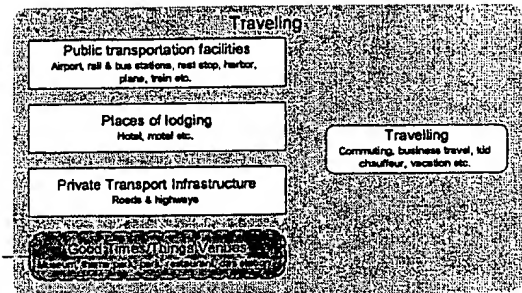
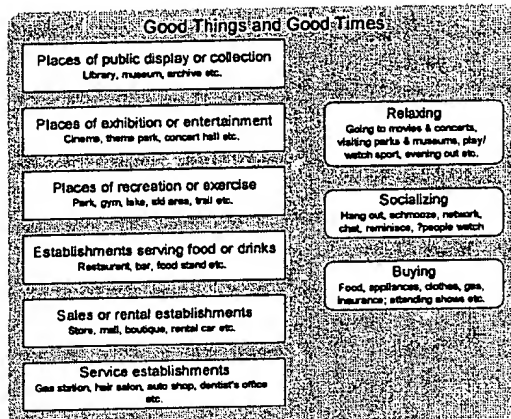


I have used the ADA taxonomy of places as a basis for generating clusters of places and their associated activities.

Two of the clusters are driven by commercial interests:

- *"Good Things and Good Times"*: shopping for necessities; socializing, and buying time/things for socializing; and recreation & relaxation.
- *"Traveling"*: this includes most of the places in the first category, plus lodging and transportation.

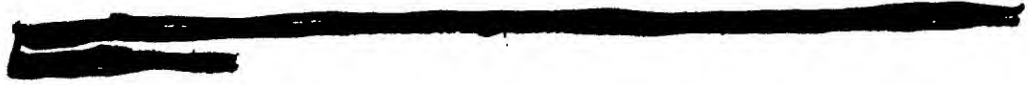
The third category, *"Social Obligation and Caring,"* is mostly non-profit. It includes interactions with government entities, participating in non-profit community activities, and learning. In the near-term this sector is likely to be strapped for resources to invest in place-based services, though government may be interested in, say, dispensing benefits via ATMs, supporting seniors in Medicare with location-aware emergency alert services, and tracking paroled prisoners.



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- **Self-organization:** boot, config, control, service/user discovery (directory)
 - **Identity establishment:** secure, many-many connections among {users, devices, services}
 - **Data access:** name, description, scope, filtering, consistency/sync, description of domain-specific protocols
 - **Behavior:** policy, eventing, invocation
 - **Communication tracking:** routing, logging, monitoring, probing, tracing, billing

Appendix 5: Card/biometric/server trade-offs

Smart card	Biometric	Data location	Notes	Scenario
yes	no	card only	Limited amount of data. PIN (i.e. weak) authentication. Not dependent on comms to a server.	Collection of IDs, some stored value, cookies; e.g. debit or loyalty card
yes	no	card & server	Unlimited amount of data, provided comms to server are available. PIN (i.e. weak) authentication.	ID's etc. card, larger files (contacts, favorites, templates) on server
yes	yes	card only	Limited amount of data. Strong authentication. Not dependent on comms to a server.	Sensitive ID's etc. and sensitive data (e.g. medical records), pointers to valuable data
yes	yes	card & server	Unlimited amount of data, provided comms to server are available. Strong authentication, not dependent on comms if biometric key saved on card.	ID's and stored value on card, larger files incl sensitive data (e.g. customer lists) on server
no	yes	server only	Biometric for authentication. All data kept on server; no limits on store size. Only usable if connection to server available	All data on server: e.g. building access control

Appendix 6: Distributed Narratives

Place-specific content feeds can create a "distributed narrative", for example a play with several concurrent streams of dialogue in a variety of places. The audience would walk through the area and encounter the story, each in a different order and in different aspects.

One possibility is a piece of installation art that represents a family drama playing itself out in a large room. Possible subjects: someone coming out to their conservative parents; or three business partners breaking up their firm; or a love triangle.

As you move about the room, you hear the dialog from the perspective of whichever person is in that part of the space. In production I imagine this would actually be a very short exchange that one experiences repeatedly from different perspectives.

Since people hear what they want to hear, each location/perspectives representation of the dialog is different; in this case, there is no objective, common truth. Someone may think they're helping another person understand something, the other party may hear a vicious flame. A third person may not hear parts of the dialog at all, either because of denial, or because they're musing about another topic - in which case we hear the internal monologue blotting out the conversation.

In order to give the experience some structure, one might use common events like a vase crashing to the floor on all of the "sound tracks". Lighting effects could be used to synchronize events and give a sense of beginning, middle and end.

Another possible structure is a more theatrical one, in which events play out once over a longer period. One can do this in a distributed sense in a series of rooms, where each room gives one a different perspective on, say, a political scandal or a family crisis. I imagine the multi-room version to be long piece where one cannot, by design, absorb all possible points of view (other than by attending multiple performances). You make choices of which places to be when stuff happens; you get a parochial view, and though you may then sample the reaction from another perspective, time has by that time moved on. This medium is well-suited to conveying historical material, for example immersing the citizen in a portrayal of two sides of the negotiations for a peace accord, or parties to a conflict, or the whisperings of courtiers in the court of the Sun King.